

For traumatic wounds, debridement, already discussed, is the most important aspect of treatment. Rest is second in importance, and the use of some antiseptic, acting as the name signifies or at least as an inhibitor of the growth of micro-organisms, is third. Specific antitoxin for the anaerobes is recommended.

Rest of the injured area is very important and often neglected. It is important, for movement ruptures the capillary and lymphatic thrombi by which the wound is isolated from the general circulation, and disturbs the cellular-healing processes. It must be done in such a manner, also, as to allow continuously an adequate circulation. Immobilization in bed or by splinting is often wise. Elevation of the extremity to aid blood and lymphatic circulation is beneficial.

The use of an antiseptic locally is no doubt of some value, but too heavy dependence on this should not be made. Today the sulphonamides are the popular drug, and in fresh wounds seem to have a bacteriostatic effect. A "lag period" of proliferation of bacteria, of five to six hours, is thought to occur. Therefore, in both fresh and in postoperative wounds their use is recommended.

As to whether primary suture, after debridement, is to be done, or whether the wound will be dressed open, is dependent upon the time and conditions under which the surgery is done. If the wound is cared for within six hours and can be properly debrided, and the patient can be kept under direct and continuous observation, certainly it is, as a rule, advisable and proper. If so done, suturing without tension should be stressed. However, if there is doubt as to the elimination of all infection, or the patient cannot be kept under observation, then the wound should be dressed open. It matters little if one uses sterile plain gauze, or an antiseptic and gauze, or any chemically-impregnated gauze for the wound dressing. Each physician has arrived, from experience, at his own conclusion, and one is as good as another.

Serotherapy, for the "gas gangrene" anaerobes, has proved its value, and we speak from personal observation and experience as well as from authentic reports in medical literature. A polyvalent anaerobic antitoxin from *Clostridium welchii*, 10,000 units, and *Clostridium vibron septicum*, 10,000 units, in the therapeutic dosage according to the clinical response, is of definite value, both, we believe, prophylactically as well as curatively. We recommend that where gas gangrene is anticipated, a therapeutic dose of gas gangrene antitoxin be given as prophylaxis, and be so given as to provide a continued source of supply for absorption by the body, namely, 50 per cent, intramuscularly, and 50 per cent subcutaneously. For treatment purposes it should be given in adequate dosage, for the reaction is on a quantitative basis. The need of treatment is judged by the pulse rate and patients' reactions generally, as well as by the local involvement. Some believe it of added value if injected locally near the wound; although theoretically, since it

acts through the circulation, it would not seem to be of any material consequence.

The orderly plan of care of traumatic wounds, occurring as visualized under civilian defense, is therefore recommended as follows:

A wound dressing of sterile gauze or antisepticized gauze or sulphonamide and gauze, should be applied at the primary dressing station or by the first aid man. Adequate immobilization should be obtained. The patient should be transferred to the base hospital where the main care is to be given preferably within six hours.

At the base hospital a thorough debridement should be done, with primary closure when advisable, and always immobilization to the injured area and elevation if indicated. If the wound postoperatively is to be dressed open, it should not be uncovered more often than absolutely necessary.

Such is the case of traumatic wounds; yet, as a final word in the care of an injured individual, let it be remembered always *the patient comes first, the wound second.*

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HEAD AND BLAST INJURIES*

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IT has been estimated that, in the bombing of cities in Great Britain, 25 per cent of all hospital entries suffered from head injuries. Therefore, the proper care for these cases cannot be overemphasized.

Two conditions are met with: those head injuries resulting from direct trauma due to flying glass, falling debris, bomb fragments, etc., and those due to blast injuries.

First aid treatment of these cases should record:

1. The presence and degree of shock.
2. The nature of the head wound.
3. The period of unconsciousness.
4. The presence of localizing signs.
5. The presence of other injuries.

All patients suffering from head injuries must be carefully observed for the early signs of shock, and the proper treatment immediately instituted.

Scalp Wounds:

Contusions of the scalp (not associated with laceration) and hematomata require no surgical treatment. Occasionally the edge of a hematoma will be rather firm and the center soft. This is often mistaken for a depressed fracture. However, the differential diagnosis is easily made by keeping firm pressure with the index finger on the edge for about ten seconds. If it is a hematoma, the edge will quickly give way. If a depressed fracture is present, the sharp edge will remain.

* One of several papers in a Symposium on "Emergency Medical Service in Wartime." Papers collected by Henry Gibbons, III.

Short, superficial lacerations which do not extend through the entire thickness of the scalp, only require shaving a small area about the wound, removal of any foreign body, application of some antiseptic, dusting with one of the sulfa drugs, and dressing.

At first aid or emergency stations treatment of the long lacerations and avulsions of the scalp should consist only in controlling hemorrhage and preventing contamination. The hair is clipped or cut from about the laceration, sulfanilamide (up to 5 grams) dusted into the wound, and a pressure dressing applied. At times it may be necessary to take a few sutures through the scalp to stop bleeding. No attempt is made to catch and tie bleeders in the scalp unless one of the main arteries has been severed. Careful preparation of the wound should be reserved until the patient has been brought into a fully-equipped hospital where complete examination, including x-ray studies, may be made, and where the proper facilities are available for taking care of all surgical complications existing underneath the wound.

Period of Unconsciousness:

It is extremely important that the state of consciousness or unconsciousness of the patient be recorded as early as possible. The period of unconsciousness is one of the best indications of the severity of a brain injury. Increasing stupor should suggest cerebral compression from intracranial bleeding. One point, which cannot be overemphasized, is the position of the comatose patient. He should be turned on his side so that he will not obstruct his air passages by secretions, vomitus, or by his tongue.

Presence of Localizing Signs:

Early and rather frequent neurological examinations are extremely important, and should be recorded, together with the time of observation. A detailed examination is not necessary. It can be done in a relatively short time without adding in any way to the shock of the patient. The most important points to determine are the evidence of head trauma (hematomata and lacerations of the scalp, depressed fractures, bleeding or escape of cerebro-spinal fluid from ears, nose, or mouth, etc.), the size, shape, and reaction of the pupils, the presence of muscle weakness or paralysis, and reflex changes.

Dilated, fixed pupils are associated with a very poor prognosis. A dilated, fixed pupil, providing the pupils at first were equal and reacted, is very suggestive of hemorrhage, either subdural or extradural. A mydriatic should never be used, as it is far more important to observe changes in the pupils than to look for signs of choked discs.

Muscle weakness or paralysis occurring immediately is the result of cerebral contusion or laceration. When it develops, after a period of time, one must consider the probability of a space-consuming hemorrhage. It is only by doing rather frequent neurological examinations that a progressing lesion will be recognized.

Presence of Other Injuries:

Head injuries, especially in bombing raids, are often associated with other injuries; and patients must be examined carefully as well for trauma to the spine, chest, abdomen, and extremities.

Treatment:

Of prime importance in the treatment of head injuries, after shock has been combated, is frequent observation of temperature, pulse, respirations, and blood pressure for signs of increasing intracranial pressure, frequent neurological examinations, and careful nursing. In fact, skillful nursing is one of the essentials in treatment of these cases, and, without it, many patients will not recover.

In the presence of large lacerations, compound fractures, or escape of cerebro-spinal fluid from ears, nose, or mouth, large doses of one of the sulfa drugs should be administered.

Many of these cases are irrational, restless, thrashing about, and extremely difficult to manage. Restraints are contraindicated. In fact, very often after the removal of such, the patient will immediately quiet down. Sideboards, as a rule, will prevent patient, from falling out of bed. Fairly large doses of phenobarbital, chloral, or paraldehyde will usually quiet them. The use of morphine as a respiratory depressant is ordinarily not advisable in head injuries. However, in rare instances it may be necessary to use this drug, when there is extreme restlessness not controlled by the usual sedatives, and in those cases in which the head trauma is associated with other injuries.

There is no fast rule in regard to the amount of fluids to be given in acute head injuries. Under ordinary circumstances the fluid intake in the first twenty-four hours is limited to 1500 c.c. However, this does not hold when a patient is in shock, has lost a great deal of fluids, has a high temperature, or has sustained other injuries.

The signs of increasing intracranial pressure are slowing of pulse and respirations, rise in blood pressure, or widening of pulse pressure, and progressing stupor. This is due either to a space-consuming hemorrhage or brain edema. The former requires surgery. The latter is relieved by limiting fluid intake, hypertonic solutions, or spinal puncture with drainage.

Lumbar puncture is often valuable both as a diagnostic and therapeutic measure. The amount of blood in the spinal fluid determines to a large extent the degree of cerebral contusion or lacerations, and aids in the prognosis. The measurement of the pressure is indicative of the degree of cerebral compression. Likewise, withdrawal of spinal fluid often results in marked improvement in the patient's condition.

A certain percentage of these head injuries will require surgery. Although it is not the purpose of this paper to discuss in detail operative procedures a few definite principals are enumerated.

Preparation of Field:

The wound is filled with sterile gauze, the hair

TABLE 1.—*Differential Diagnosis Points*

	Contusion Laceration	Extradural Hemorrhage	Chronic Subdural Hematoma
Unconsciousness	Immediate.	Stupor coming on after a latent period. If initial injury, severe latent period may be absent.	Latent period varies from few weeks to many months.
Temperature	Fall at first due to shock. Rise, following, depending on severity. When above 104 degrees, recovery rare.	No rise.	No rise.
Pulse and Respirations.....	Rapid in shock. Slow in medullary involvement. Rapid in medullary failure.	Slow.	Slow.
Blood Pressure or Pulse Pressure..	Increase with medullary involvement.	Increased.	No increase.
Spinal Fluid	Contains blood—amount depends on severity. Pressure varies.	No blood unless contusion or laceration present. Pressure increased.	Either slightly blood tinged, xanthochromic or clear. Pressure varies.
Neurological Findings			
(a) Weakness or paralysis.....	Immediate.	Late and progressive.	Gradual and progressive. Occasionally on same side as hemorrhage.
(b) Pupils	Often dilated on side of lesion. Dilated and fixed prognosis poor.	Dilated, as a rule, on side of hemorrhage.	Often dilated on side of hemorrhage.
(c) Ophthalmoscopic	Negative first 24 hours, at least.	Negative.	Bilateral choked discs occasionally present; greater on side of hemorrhage.
X-ray Findings	Fracture may or may not be present.	Fracture line crossing middle meningeal groove usually present.	Usually no fracture. Pineal shifted.

clipped and shaved from a large area about the laceration, and the field is scrubbed with soap, and irrigated with sterile water. Fresh sterile gauze is then replaced in the wound, the area painted with an antiseptic, and draped. The most convenient and best draping is moist towels rung out of bichloride of mercury (1 to 1000).

Anesthesia:

Operation on these patients is best carried out under either local anesthesia, novocaine 1 per cent solution with 3 drops of adrenalin (1 to 1000), to the ounce, or pentothal sodium intravenously. If the latter is used, one must give the initial injection slowly, and have oxygen ready in case there is any respiratory embarrassment.

Operation:

Scalp wounds should be thoroughly debrided and enlarged, if necessary to obtain adequate exposure of any underlying pathology. All foreign material should be carefully removed. Depressed fractures should be elevated or removed. An intact dura should not be opened unless a subdural hemorrhage is suspected. Dural tears should be debrided. All devitalized brain tissue should be removed by irrigation and suction. Superficial foreign bodies imbedded in the brain should be removed, providing their removal does not result in further damage to important areas. The wound, before being closed, should be dusted with either sulfadiazine or sulfanilamide. If drainage is indicated, it should be done through a stab wound.

Extradural Hemorrhage:

These hemorrhages usually occur within the

first twenty-four hours, and demand immediate operation. The typical history is loss of consciousness immediately following the accident due to the concussion, a varying period of consciousness followed by increasing stupor, signs of increased intracranial pressure—usually some motor paresis,—and a dilated fixed pupil on the side of the hemorrhage. Treatment is subtemporal decompression, evacuation of the clot, and ligation of the middle meningeal artery.

Subdural Hematoma:

Subdural hemorrhages may be either acute or chronic. The acute subdural hemorrhages are usually associated with a laceration and contusion of the brain. Operation on these cases is sometimes helpful. The chronic subdural hemorrhages follow apparently minor head injuries, cause symptoms from one to several weeks to even months after the accident. The symptoms are those associated with chronic increased intracranial pressure, namely, headache, nausea and vomiting, visual disturbances, increasing stupor, etc.

Frequently, in these cases, the neurological examination is negative; occasionally, however, definite localizing signs are present. Often the only finding is a dilatation of the pupil on the side of the hemorrhage.

The spinal fluid may be clear or xanthochromic, its pressure normal or elevated. As a rule the total protein is increased.

If the pineal gland is calcified, the diagnosis may often be made by noting a shift of the gland in direct P.A. x-ray views of the skull.

The treatment is operation. Usually trephine openings, with drainage of the hematoma, is sufficient. Occasionally, it will be necessary to turn down an osteoplastic flap. One must also remember that they are not infrequently bilateral.

Blast Injuries:

Although there are many unanswered questions relative to blast injuries, certain facts have been fairly well established, both clinically and experimentally.

Individuals in close proximity to an explosion, either in air or water, may be killed or seriously injured from the effects of the externally applied pressure wave.

The most common lesions are found in the lungs and gastro-intestinal tract. Lesions are also found in the brain, spinal cord, liver, spleen and kidneys. Air blasts are more likely to produce serious lung lesions, whereas water blasts tend to produce lesions of the intra-abdominal organs. However, serious lung and intestinal lesions may occur with both types of blast injuries.

The pulmonary lesions are bilateral, and vary from alveolar damage and rupture, with capillary bleeding into the smaller bronchioles, to extensive injury and destruction of the large portions of lung tissue, with occlusion of large bronchi with blood clots. Pulmonary edema may occur later in varying degrees.

Two types of lesions are met with in the gastro-intestinal tract, namely, contusions and hemorrhage of the bowel wall and perforations. Experimentally, these changes are in direct proportion to the amount of gas in the lumen; and this explains why lesions are more common in the large bowel. Lacerations and contusions of the liver, spleen, and kidneys have been described, but are rare and not seen when normal experimental animals are exposed to blast injuries.

Petechial hemorrhages in the brain and spinal cord have been described by numerous writers. These patients suffer from headache, loss of memory, personality changes, irritability, motor weakness and convulsions.

Treatment:

Persons who have been close to exploding bombs, even if they show no evidence of injury, require observation for twenty-four hours.

Shock is common in these cases, must be looked for, and properly treated if it occurs. Providing the patient's condition permits, x-rays should be taken of chest and abdomen.

The treatment of the chest injuries will be essentially symptomatic: absolute bed rest, sedatives, and oxygen administration for respiratory embarrassment. Pulmonary edema may require hypertonic solutions and vena section. If pneumonia develops, appropriate sulfa-therapy is indicated.

The treatment of intraabdominal injuries will require careful judgment, especially since these casualties also have, as a rule, definite lung pathology. The perforation of a viscus is the one

indication for immediate surgical intervention. This diagnosis is rather difficult to make unless the x-ray films of abdomen show the presence of free-air in the peritoneal cavity, or unless there is evidence of spreading peritonitis. When perforation or peritonitis is suspected, continuous gastric suction by the Wangenstein or similar apparatus should be instituted immediately, and continued after operation. The anesthetic, in view of the lung pathology, is local, supplemented by pentothal sodium if necessary.

The therapy of the central nervous system lesions is the same as indicated in cerebral concussion and contusions, because, as stated, petechial hemorrhages scattered throughout the brain are the common lesions.

If cerebral symptoms continue, or especially if they become more marked, the possibility of subdural collection of fluid must be considered; and if diagnostic procedures indicate their presence, trephine and drainage should be carried out.

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THE HOSPITAL: IN EMERGENCY MEDICAL SERVICE*

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SINCE December 7, 1941, the hospitals in the State of California have been undergoing an extensive preparation to defend their plants against damage by fire or enemy bombs. During the same time, they have been carrying on extensive plans for the organization of the personnel, so that they might be prepared to receive large numbers of casualties for treatment within their walls. The interest in the above two programs has increased and waned in keeping with our successes and failures in the Pacific. At the present time, interest in not only hospital protection, but in all types of civilian defense has reached a very low ebb, and it is with much effort on the part of committees that the program is kept alive. It would not be correct to say that the effort of the past many months has been without value, for in a State where natural disaster has previously occurred with much destruction of life and property, any review of our disaster plans is extremely valuable. Many points have been learned from the program to date.

FIRE PROTECTION

Since the outbreak of the war, all buildings have been reviewed for fire equipment. Attics have been cleaned out and roofs have been made more accessible. Perhaps for the first time in many years, fire extinguishers have been completely rechecked and refilled; auxiliary fire fighting apparatus and trucks have been established

* One of several papers in a Symposium on "Emergency Medical Service in Wartime." Papers collected by Henry Gibbons, III.

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